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ABSTRACT

This report, part of the 1972-73 Unified Science and Mathematics for Elementary Schools (USMES) evaluation project, focuses on the effect of the USMES curriculum on the organization and operation of the classroom. For the study, 30 USMES classrooms and 30 non-USMES classrooms were used. Each trained classroom observer, utilizing classroom environment instruments for large group and for small group observation, visited USMES and control classrooms nine times in a period of one year. Several classroom activities were marked for frequency of occurrence, and interactions were tallied as either child-child or child-teacher. Chi-square analysis was used to compare USMES and non-USMES scores in a variety of categories. The most dramatic differences were found to be a greater amount of small group work in USMES classes, the far larger number of ideas added by USMES students during class discussions, and the higher incidence of child-child interaction during small group work in USMES classes. (Author/CP)

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USMES EVALUATION REPORT
ON
CLASSROOM STRUCTURE AND INTERACTION PATTERNS
1972-73 USMES EVALUATION PROGRAM

June, 1974

Based on detailed report prepared by
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Introduction

The 1972-73 USMES evaluation focused on the following general questions:

(a) Did the USMES program foster problem solving capabilities?

(b) Did exposure to the USMES curriculum have any effect on basic skills development in reading and arithmetic?

(c) Did the USMES curriculum lead to a different organization of the classroom and a different pattern of interaction within the classroom?

Specific answers to the first two of these questions can be found in other reports. In general it appeared (i) that the USMES curriculum did, indeed, foster superior problem solving behavior in elementary school children, and (ii) that most comparisons of USMES classrooms with control classrooms found no differences in the development of basic skills in reading and mathematics.

It is the third question, that relating to classroom organization and interaction, with which this report is concerned. The USMES curriculum by its very nature encourages small group work with students interacting with each other more than would be the case in a non-USMES classroom. The USMES curriculum was also seen as encouraging a more flexibly organized classroom, one in which there might be many changes from large to small group to individual instruction depending upon the instructional needs of the moment. The purpose of the present inquiry was to ascertain to what extent these intended outcomes materialized in the actual classroom.

As this report will show, an USMES classroom has important differences in structure and activity from a non-USMES class. Many of the intended effects of having children become involved with a "challenge" are strongly evident. The most dramatic differences are the greater amount of small group work in USMES classes, the far larger number of ideas added by USMES students during class discussions, and the higher incidence of child-child interaction during small group work in USMES classes.

Method

(a) Subjects

The sampling unit was the individual classroom (USMES or control). There were thirty USMES classrooms (fifteen in a National sample and fifteen in a Lansing, Michigan School District sample) and thirty control or non-USMES classes (also fifteen in both the National and the Lansing District samples). The control classes were matched in terms of grade level and school building with the USMES classes, but should not be considered careful matches to the experimental units in any very strict sense. The classes in the National sample came from a range of socioeconomic and geographic settings. Classes in both samples ranged from grades one through six.

(b) Procedure

The data was gathered by trained classroom observers using two classroom environment instruments, one for large group and one for small group observation. The instruments were developed especially for this investigation, and copies of them are attached to this report. Each observer was to visit each classroom--USMES and control--nine times in the course of the 1972-73 school year: three visits in the fall, three in the winter, and three in the spring, with the specific dates to be worked out by the individual observers and participating teachers.

The observer, upon entering a classroom, indicated on the cover sheet of the instruments the type of classroom organization in evidence at the moment--large (whole) group, small group, or individual. He/she would then use the appropriate scale to record the occurrences of specific behaviors for the new type of class structure. For example, if upon entering the

class, the observer noted that the class was working in small groups, the observer recorded this and proceeded to use the small group scale. If the class then changed to a large group organization, the observer noted this and switched to recording on the large group scale.

The large group observation scale had seven general classifications for observed behavior. These were: (i) responds to teacher's specific question, (ii) adds idea, (iii) reiterates idea, (iv) presents work--demonstrates, (v) changes subject--makes random comment, (vi) debates--argues, and (vii) plays games.

The small group observation scale also had seven general classifications of behavior. These were broken down into verbal and non-verbal behaviors. The verbal behaviors were: (i) answers questions (makes specific response), (ii) asks questions, (iii) adds ideas, (iv) debates--argues, (v) makes other comment. The two non-verbal categories were: (i) aids and (ii) hinders. Each instance of these small group behaviors was also classified as either "child-child" or "child-teacher", depending upon who the participants in the interaction were.

Results

(a) Classroom Structure

The information concerning the type of classroom structure (i.e., the form of instruction being used) is reported for each grade level in Table 1, where the data from the National and the Lansing District sample have been combined. The data was obtained by averaging the total frequencies of each structure across the fall, winter, and spring observation periods. It was necessary to average these as the observers could not adhere strictly to the observation schedules.

In comparing the USMES and the control classes, statistically significant differences relative to the frequencies of various classroom structures were found at grade levels two through six. In general, there was a clear tendency for the USMES classes to be in large groups as often as the control classes, and this was true across all grade levels. An examination of the "small group" and "individual" instruction categories revealed that the USMES classes used "small group" instruction very much more frequently, while students in the control classes were much more likely to be working on an individual basis.

The information about class structure was also analyzed by USMES unit, and statistically significant differences were found for the following USMES units: Burglar Alarm Design, Pedestrian Crossings, Soft Drink Design, Designing for Human Proportions, and Consumer Research. The pattern to be described for these units was also found in the other units, but the magnitude of the effect in these latter cases was not as pronounced. In general, the grade level pattern previously reported was also apparent for the units. That is, both the USMES and control classes used large (i.e., total) group instruction while the USMES classes used more small group instruction and the control classes used more individual instruction. Two of the units deserve special comment. The Burglar Alarm seemed to be more small group than large group oriented, and the reverse was true for Describing People. In all other USMES units, there was either equal use of both structures, or large groups were used a little more frequently.

The data relative to classroom structure were also considered in terms of the number of times the classroom structure was altered in the course of the observation period which was approximately one hour in length. The

frequencies of change here reported are for all classes in each of the three observation periods--fall, winter, and spring. The actual number of changes ranged from zero to five or more. In comparing the frequencies of structural changes within the classes, statistically significant differences between the USMES and the control classes were found only for the fall observation period in both the National and Lansing District samples and in the summation across all periods for the Lansing District sample. In both the National sample and the Lansing District sample, the fall observations indicated that the USMES classes tended to change structure more frequently during the observation period, but this differentiation is not apparent in the observations made later in the school year.

Combining across both the National and the Lansing District samples and the three seasonal sets of observations, and using only two categories: (i) no change and (ii) one or more changes, shows that overall, there was a statistically significant tendency for the USMES class structure to change more often than was the case for the control units.

(b) Large Group Observation Scale

While it was found that both the USMES and the control classes utilized large (i.e., whole or total) group instruction to much the same extent, the interactions within this form of instruction were found to be different for the USMES and the control classes. These results for the National sample are presented in Table 2 while those for the Lansing District sample can be found in Table 3. The frequencies reported in these tables represent the summation of the behaviors across the three seasonal observation periods.

As can be seen from the two tables, chi-square analyses of the USMES and control classes in both samples yielded statistically significant and sometimes

very contrasting results. Examination of the frequencies within the interaction categories themselves yields the following results:

(1) The frequency of children responding to specific (close-ended) questions posed by the teacher is considerably lower in the USMES than in the control classroom.

(2) Children in the USMES classrooms tend to contribute ideas much more often than do their counterparts in the control classrooms. (This is the largest difference between the two groups.)

(3) In the Lansing District sample, there was a higher incidence of reiterating ideas in the control classes.

(4) In general, there was no difference between the USMES and the control classes in terms of the frequency of children presenting work or demonstrating to the whole class.

(5) There was a much larger amount of random conversation and changing of the subject in the control than in the USMES classrooms.

(6) There was somewhat more debating and arguing in the USMES classes.

(c) Small Group Observation Scale

In the analyses of these data, the USMES and the control classes were considered separately. In each case, the data were examined to determine if differences existed relative to the incidence of the type of interaction (i.e., child-child vis a vis child-teacher) within small groups.

In this analysis, the assessment of the relationship between the specific small group behavior and the participants in it yielded statistically significant results. In the classes of the National sample, child-child interactions were more common in all categories in both USMES and control classes except--interestingly enough--in "answers questions", where in the control classes the

child-teacher mode was the more frequently boserved. The same pattern was observed relative to the Lansing District sample.

These data were also organized so as to examine directly any differences between USMES and control classes within the child-child and teacher-child interaction categories. This comparison can be seen below in Tables 4 and 5 for the National sample and Tables 6 and 7 for the Lansing District sample. These comparisons yielded statistically significant results, and they indicated that there was more child-child interaction in the USMES than in the control groups in all categories except "debates--argues" in the National sample. In terms of child-teacher interaction, however, the results are almost the reverse. The pattern is clearly that the incidence of this kind of interaction within small groups is higher in the control than in the USMES units.

In the brief description of the observation instruments given above, it was indicated that the small group observation scale had both verbal and non-verbal observation categories. The data presented above, however, has been limited to the verbal categories. Analysis of the non-verbal behaviors was not possible due to the extremely infrequent use of these categories by the classroom observers. Nevertheless, on a conceptual level, the category remains potentially fruitful. Therefore, in future instrument development, it will be given further attention.

Conclusion

There were several strong differences between the USMES and control classes which emerged in this study:

(1) Although both USMES and control classes exhibit extensive use of whole-group instruction, departures from this traditional mode were decidedly

more in the direction of small-group organization for the USMES classes while they were in the direction of individual work for the control classes.

(2) There was some evidence that the USMES classes change classroom structure more often than the control classes. In particular, during the fall observation series, there were more changes for the USMES classes than for the control classes.

(3) Within the whole-group mode, the USMES classes were characterized by higher levels of contributing ideas and debating and by lower levels of responding to closed-ended teacher questions, reiterating of ideas, and random conversation. The amount of contributing of ideas by students in USMES classes was particularly striking.

(4) Within the small-group mode, the USMES classes were characterized by more child-child and less child-teacher interaction.

Thus, the results of the classroom observations indicated that not only are the USMES classes structured differently than the control classes, but they are also characterized by differing types of interaction within the form of instructional organization being used.

Table 1

Frequency of Classroom Structures
by Grade Level: National
and Lansing Samples

Grade Level	Group	Structure				Chi Square
		Whole Group	Small Group	Individ.	Small/ Individ.	
6	USMES	50	35	9	4	12.85*
	Control	49	10	20	12	(3)**
5	USMES	19	13	5	2	12.12*
	Control	19	1	11	2	(3)
4	USMES	20	19	6	2	21.54*
	Control	24	3	20	0	(3)
3	USMES	31	28	5	14	27.42*
	Control	40	4	19	12	(3)
2	USMES	15	4	1	0	7.70*
	Control	21	0	6	0	(2)
1	USMES	3	1	2	0	2.07
	Control	4	1	0	0	(2)
2/3 ***	USMES	11	2	7	0	6.80
	Control	3	5	3	1	(3)
4/5/6***	USMES	9	5	1	0	2.11
	Control	9	1	1	0	(2)

* statistically significant at the five percent level
** figures in parentheses are the associated degrees of freedom
*** children at the grade levels indicated were combined in a single classroom

Table 2

Frequency of Specific Behaviors in Large Group Observations : National Sample

Behavior	Group	
	USMES	Control
Responds to Teacher Question	310	730
Adds Ideas	1083	554
Reiterates Idea	69	69
Presents work-Demonstrates	47	12
Changes Subject-Random Comment	134	387
Debates-Argues	20	12
Game	1	2

Chi Square(df=6) = 427.33 *

* statistically significant at the five percent level

Table 3

Frequency of Specific Behaviors in Large Group Observations: Lansing Sample

Behavior	Group	
	USMES	Control
Responds to Teacher Question	338	485
Adds Ideas	1085	844
Reiterates Idea	262	373
Presents work-Demonstrates	43	78
Changes Subject-Random Comment	460	848
Debates-Argues	7	2
Game	4	2

Chi Square(df = 6) = 166.96 *

* statistically significant at the five percent level

Table 4

Frequency of Verbal Behaviors in Small Groups: Child-Child Interactions : National Sample

Behavior	Group	
	USMES	Control
Answers Questions	151	57
Asks Questions	348	187
Adds Ideas	1682	302
Debates-Argues	24	31
Other Comments	326	124

Chi Square(df=4) = 156.35 *

* statistically significant at the five percent level

Table 4

Frequency of Verbal Behaviofs in Small Groups: Child-Teacher Interqctions: National Sample

Behavior	Group	
	USMES	Control
Answers Questions	83	142
Asks Questions	61	38
Adds Ideas	162	51
Debates-Argues	1	0
Other Comments	4	17

Chi Square(df=4) = 81.64 *

* statistically significant at the five percent level

Table 5

Frequency of Verbal Behaviors in Small Groups: Child-Child Interactions : Lansing Sample

Behavior	Group USMES	Control
Answers Questions	275	91
Asks Questions	288	115
Adds Ideas	1129	216
Debates Argues	83	3
Other Comments	445	375

Chi Square(df=4) = 253.62 *

* statistically significant at the five percent level

Table 6

Frequency of Verbal Behaviors in Small Groups: Child-Teacher Interactions : Lansing Sample

Behavior	Group USMES	Control
Answers Questions	67	129
Asks Questions	44	65
Adds Ideas	85	94
Debates-Argues	0	1
Other Comments	19	63

Chi Square(df=4) = 16.59*

* statistically significant at the five percent level

USMES OBSERVATION REPORT

Date_____ Class_____

Observer_____ School_____

Unit_____ USMES or Control_____

General Reorganizations of Class:

Total Group	+	+	+	+	+	+	+
Small Groups	+	+	+	+	+	+	+
Individuals	+	+	+	+	+	+	+
Time	⟶						

Observer's Notes and Impressions:

OBSERVATION OF CLASS DISCUSSION Page ____

DATE_____ CLASS_____ UNIT_____

TIME: START_____ END_____

CATEGORY	OCCURENCES (TALLY)
1. Responds to teacher's specific question	
2. Adds Idea	
3. Reiterates Idea	
4. Presents work-Demonstrates	
5. Changes subject makes random comment	
6. Debate-Argument	
7. Game	

PURPOSE OF CLASS DISCUSSION_____

SMALL GROUP OBSERVATION FORM Page _____

DATE_____ TEACHER_____ UNIT_____

GROUP_____ NO. OF CHILDREN_____ ACTIVITIES

TIME_____ NO. OF TEACHERS_____

INTERACTIONS: TIME: Start_____ END_____

Verbal:	CHILD-CHILD	CHILD-TEACHER
1. Answers question (makes specific response)		
2. Asks question		
3. Adds idea		
4. Debates-argues		
5. Makes other comment		
Non-verbal:		
6. Aids		
7. Hinders		